Modernizing
FEMA's
Flood Hazard Mapping Program

A Progress Report

November 1997

Foreword

This report presents actions required to modernize FEMA's Flood Hazard Mapping Program. It was prepared in response to a request by Director James L. Witt for information on how the flood hazard mapping program could be improved to better serve the citizens of the United States.

Michael J. Armstrong
Associate Director for Mitigation

Our Planning Process

In May 1997, the Federal Emergency Management Agency's (FEMA's) Hazard Identification and Risk Assessment Division of the Mitigation Directorate and the Mitigation Divisions of the Regional offices convened a Task Force to plan the future of FEMA's Flood Hazard Mapping Program. The effort was led by Senior Staff, listed below:

Michael J. Armstrong, *Associate Director for Mitigation*
Richard W. Krimm, *Executive Associate Director*
Craig Wingo, *Deputy Associate Director*
Michael K. Buckley, *Director, Hazard Identification and Risk Assessment Division*
Frederick H. Sharrocks Jr., *Chief, Hazard Identification Branch*
Gil H. Jamieson, *Chief, Risk Assessment Branch*

Out of this Task Force, eighteen work groups were formed to assess specific areas of the mapping program. The work groups were led by the following personnel from the National and Regional offices:

Matthew B. Miller, *Task Force Manager*
Larry Basich
Doug Bellomo
Vince Brown
Carl Cook
Mike Grimm
Ken Hinterlong
Alan Johnson
Mary Anne Lyle
Kathy Miller
Karl Mohr
Phil Myers
Mary Jean Pajak
Priscilla Scruggs

In relationship to their areas, each group surveyed the current state of the mapping program, investigated options for improvements, made recommendations, and estimated costs for the recommendations. The work groups met as individual groups and as one combined Task Force to ensure that their efforts were coordinated.

This report is the initial result of the Task Force. It surveys the current state of FEMA's Flood Hazard Mapping Program, presents a visionary plan for the future, and details the strategies for implementing the plan. The individual work group reports, which provide the details of each aspect of the plan, will serve as references as the plan is implemented in the years ahead.

During this process, key advisors helped to shape the plan. Special thanks go to Mike Robinson, Chief of the Mitigation Directorate's Program Coordination Branch; Susan Bernstein, Insurance Examiner for the Office of the Federal Insurance Administration; Katie Hayden, Program Specialist, Technical Assistance Branch of the Mitigation Directorate; and Anne Flowers, John Magnotti, and Mark Whitney of the Hazard Identification and Risk Assessment Division technical staff.

The Task Force is especially grateful to the members of the Technical Mapping Advisory Council, who served as advisors to the work groups. These members, listed below, represent various map user constituencies, and, with their expertise and committed involvement, they have helped to ensure a plan that will meet the expectations of the map users.

Mark Riebau, *Council Chair, American Society of Civil Engineers*
Peggy Bowker, *National Flood Determination Association*
Kari Craun, *U.S. Geological Survey*
Donald Hull, *Association of American State Geologists*
Brian Hyde, *Association of State Floodplain Managers*
Lewis Lapine, *Under Secretary of Commerce for Oceans and Atmosphere*
Wendy Lathrop, *American Congress on Surveying and Mapping*
Albert LeQuang, *Federal Home Loan Mortgage Corporation*
Michael Moye, *NationsBanc Insurance, Inc., representing regulated lending institutions*

The Task Force was also well served by FEMA's Technical Evaluation Contractors–Dewberry & Davis and Michael Baker Jr., Inc., and Map Service Center Contractor, Aspen Systems Corporation. These firms provided logistic and technical assistance, as well as thoughtful advice, throughout the planning process.

Executive Summary

The Federal Emergency Management Agency (FEMA) Flood Hazard Mapping modernization plan will improve:

- map accuracy and completeness,
- map utility,
- map production, and
- public awareness and customer service,

and it will reduce the burden on taxpayers for disaster relief and maintain the maps as one of the most valuable national resources for flood hazard mitigation.

The approximately 100,000 map panels produced through FEMA's Flood Hazard Mapping Program are one of our nation's most valuable resources for flood hazard mitigation. They are vital to FEMA's Strategic Goals and will be key to the Disaster-Resistant Communities initiative. Although the maps were originally produced to support flood risk determinations for the National Flood Insurance Program (NFIP) and continue to serve this critical role, their uses have broadened considerably. However, funding for updating and maintaining the maps continues to come almost exclusively from flood insurance policyholders.

Each of the 15 million mortgages transacted each year and every building permit issued by a community requires the use of the flood hazard maps. They are most frequently used by insurance companies and agents, lenders, property owners, flood map determination firms, and real estate professionals as part of the mortgage transaction process. However, they are also used by floodplain managers, community planners, surveyors, engineers, and disaster and emergency response officials for mitigation, risk assessment, and disaster preparedness, response, and recovery activities.

Unfortunately, the maps are aging. Approximately 45% of the maps are at least 10 years old, and 70% are 5 years or older. The effect of the aging is that many of the maps are inaccurate; they reflect engineering analyses that are out of date as a result of subsequent development or because newer data and/or improved study methods are now available. Also, many maps show flood-prone areas that were analyzed using only approximate methods that are not adequate for sound floodplain management. In addition, there remain flood-prone communities and flooding sources nationwide that are unstudied, even by approximate methods.

The aging of the map inventory also affects the utility of the maps. The manual cartographic methods used to prepare the maps limit their utility for automated flood insurance determinations, response and recovery, risk assessment, and engineering activities, all of which are possible with present Geographic Information Systems technologies. The manual methods also limit FEMA's ability to distribute the maps electronically and perform cost-effective revisions to the maps.

To provide an inventory of the flood hazard maps in need of updating, FEMA has implemented a Five-Year Map Update Needs Assessment process. This process requires that the flood hazard map for each community be evaluated for update needs at least once every 5 years. The table below summarizes the map update needs for the mapping inventory based on screening efforts through June 1997. This screening included 10% of the communities participating in the NFIP. The estimated mapping needs will change as greater numbers of communities are contacted.

Summary of Map Update Needs

Estimated Map Panels	Mapping Need
25,000	Flood Data Update
40,000	Map Maintenance only*
35,000	Require No Revisions
13,700	Flood-Prone Communities without FEMA Flood Hazard Maps

* Map maintenance involves updating non-engineering reference features, such as roads, corporate limits, and elevation reference marks.

Modernizing the Mapping Program

FEMA's Flood Hazard Maps have served the nation well for flood disaster mitigation and relief, and, as noted previously, their uses have expanded beyond the NFIP. However, the problems of the aging map inventory must be addressed to maintain the maps' viability. Technology now provides the means for modernizing the maps and for resolving other limitations of the program. Such a modernization must begin with a plan; therefore, the Mitigation Directorate of the National office and the Mitigation Divisions of the Regional offices have designed one.

As a result of this plan, state and community officials, private property owners, and others will be made more aware of flood hazards nationwide. It is, therefore, likely that more flood insurance policies will be sold, and safer communities will be built. Thus, the plan will reduce the burden on the general taxpayer for disaster relief and maintain the maps as one of the most valuable national resources for flood hazard mitigation.

The cornerstones of the plan are to use state-of-the-art technology to cost-effectively:

- develop accurate and complete flood hazard information for the entire nation;
- provide that information in a readily available, easy-to-use format; and
- alert and educate the public regarding the risks of flood hazards.

A key element of this modernization plan will be the greatly expanded use of the World Wide Web via the Internet. The long-term goal is for all FEMA's Flood Hazard Maps and mapping-related products and data to be available via the Internet. In addition, the Internet will be key to providing public awareness and education campaigns and enhancing customer service.

This plan will use existing digital engineering, mapping, information management, and electronic communication technologies to improve the program in four primary areas: ***map accuracy and completeness; map utility; map production; and public awareness and customer service.***

Map Accuracy and Completeness

To address the needs of the mapping inventory and improve the maps' accuracy and completeness, initiatives are planned in four areas: *flood data updates; map maintenance; communities without FEMA Flood Hazard Maps; and post-flooding disaster hazard verification.*

Flood Data Updates: To address the needs of communities with outdated or inadequate flood hazard data, flood data updates consisting of field reconnaissance, engineering analyses, and floodplain mapping will be conducted for approximately 25,000 existing map panels. In conducting these updates, emphasis will be placed on improved analysis methodologies and topographic data to delineate the floodplain boundaries. Whenever feasible, flood data updates will integrate digital topographic and flood data. Additionally, detailed flood studies will be conducted for approximately studied or unstudied flood-prone communities or areas where development exists or is anticipated.

Map Maintenance: To address the needs of communities with adequate flood hazard data but inadequate non-engineering data, updated maps will be prepared for 40,000 existing map panels. As part of this effort, new base map standards will be developed and implemented. Additionally, new elevation reference mark standards will be developed and implemented emphasizing the use of Global Positioning System surveying technology and the National Geodetic Survey national network of approximately 580,000 accurate benchmarks.

Communities without FEMA Flood Hazard Maps: Flood hazard data and floodplain mapping will be developed, and approximately 13,700 new map panels will be prepared for an estimated 2,740 flood-prone communities that do not have FEMA Flood Hazard Maps.

Post-Flooding Disaster Hazard Verification: An operating procedure for evaluating the accuracy of and, if warranted, revising the flood hazard maps will be developed and implemented as part of the standard FEMA response and recovery effort for Presidentially declared flooding disasters.

Map Utility

The efforts to address the accuracy and completeness of the flood hazard maps will be synchronized with a 7-year plan to convert the mapping inventory to a digital format. To achieve this, the DFIRM 2.0 and 2.1 map products will be developed and introduced.

- The DFIRM 2.0 product will be used for communities with only map maintenance needs and will serve as the transition to DFIRM 2.1, which will include engineering analysis prepared to address flood data update needs for a community.

- The products will have compatible digital data specifications and will be distributed through the FEMA Map Service Center in hard-copy (paper) and soft-copy (digital) formats.

- Both products (in their hard- and soft-copy formats) will serve as the regulatory map.

- The digital copies will be distributed on CD-ROM and, in the long term, via the Internet through the Map Service Center web site.

The primary difference between the DFIRM 2.0 and 2.1 products will be in their level of engineering analysis and data structure. As part of the DFIRM 2.1, an electronic Flood Hazard Report will be developed. The Flood Hazard Report will contain engineering backup data and other flood-related information directly linked to map features, providing instant access to useful information.

Map Production

To provide for more cost-efficient, timely production of maps and map updates, initiatives are planned in three areas: *FEMA-funded flood data updates; Letters of Map Change;* and *Cooperating Technical Community agreements*.

FEMA-Funded Flood Data Updates: In developing updated flood data for 25,000 existing panels discussed above, the processes for creating and maintaining the maps will be streamlined. The existing process is linear, has evolved over the 25 years of the program, and results in nearly 5 years to complete an update. Therefore, the process will be re-engineered. Features of the new process include:

- the implementation of a more efficient contracting mechanism for conducting the engineering analyses and mapping;

- increased up-front coordination with the state, community, and other Federal agencies; and

- interim submittal to, and review by, FEMA of analyses and mapping throughout the study process, made possible by utilizing state-of-the-art electronic communication technologies.

Pilot studies currently being conducted indicate that both study costs and turnaround time will be decreased using this new process. It is estimated that the average time required to produce a FEMA-funded flood data update can be reduced from 58 to 33 months, a decrease of 45%.

Letters of Map Change: The processes for reviewing Letter of Map Change requests initiated by communities and/or property owners will also be streamlined. It is projected that these requests will be approximately 12,000 in Fiscal Year 1997, a 425% increase since 1993. By streamlining the processes, the workload should be lessened. This will allow more funds to be devoted to flood data updates, the fundamental purpose of FEMA's Flood Hazard Mapping Program. As a long-term change also intended to decrease the workload volume, the possibility of delegating the issuance of Letters of Map Amendments and Letters of Map Revision - based on Fill to qualified professional surveyors and engineers will be investigated.

Cooperating Technical Communities: To enhance the revised processes for conducting FEMA-funded flood data updates as well as reviewing Letter of Map Change requests, the concept of Cooperating Technical Communities will be introduced and pursued. These will be formal partnerships whereby a state or local agency will contribute engineering and/or mapping to the flood hazard mapping process. Standardized partnership agreements will be prepared to make implementation more efficient and effective. These agreements will complement the *Disaster Resistant Communities* initiative.

Public Awareness and Customer Service

To deliver these more accurate, useful mapping products and to better inform the public of the risks of flood hazards, public-awareness and customer-service initiatives will be implemented. To promote the public awareness of, and confidence in, FEMA's Flood Hazard Maps and mapping processes, a formal outreach and education program will be developed. This will include:

- expanded use of FEMA's web site;
- establishment of a customer-service telephone response line for the mapping program; and
- development and distribution of educational materials, such as brochures and video training courses.

To make the FEMA Flood Hazard Maps readily accessible and increase customer service, efforts will be concentrated on the Map Service Center, which distributes the maps and related products and is one of FEMA's busiest customer centers. For the foreseeable future, the maps will continue to be printed on paper to serve the needs of many users who still operate in a hard-copy environment; therefore, cost-effective alternatives to the traditional printing methods employed by the Government Printing Office, such as printing on demand from an electronic file, will be developed to provide reliable service designed to support the DFIRM 2.0 and 2.1 products and eliminate backordered or out-of-stock items at the Map Service Center. For inventory control and distribution efficiency, bar code technology will be implemented for the hard-copy maps. In addition, the distribution processes will be enhanced to distribute the DFIRM 2.0 and 2.1 digitally, initially on CD-ROM and eventually via the Internet through the Map Service Center's web site. Other enhancements designed to easily, quickly, and conveniently provide needed information and service to the customer will be provided through the Map Service Center's web site and telephone response center.

Funding for the Mapping Modernization Plan

Presently, funding for FEMA's Flood Hazard Mapping Program comes primarily from a $30 Federal Policy Fee charged to each flood insurance policy. The only other source of funding for mapping comes from a fee charge system for reviewing and processing map revision requests and for printing and distributing the maps and engineering backup data. The fee charge system accounts for approximately 5% of the funding for the mapping program; the remaining 95% comes from the Federal Policy Fee. Funding for Fiscal Year 1997 was approximately $46 million, and the demand from the broadened user base for map products has significantly outgrown available funding.

What's Next?

A benefit/cost analysis of the plan is currently being conducted. Although the costs related to new technology are difficult to measure, the goal is to determine if the benefits can be expected to justify the costs and to determine the relative merits of each of the recommendations.

While the benefit/cost analysis is being conducted, several initiatives that support the modernization plan are planned or underway. First, the various map user groups will be consulted for their assistance in prioritizing the recommendations. In addition, those recommendations that involve no, or minimal, additional cost are being identified and implemented. An example is the recommendation to revise the

process for conducting FEMA-funded flood data updates. Also, the specifications for the DFIRM 2.0 and 2.1 products, and for base maps are being developed. Further, a management structure for successfully implementing the modernization plan is being developed. Finally, pilot studies that may serve as the building blocks for conducting flood studies in the future are being pursued as part of the Director's Disaster Resistant Communities initiatives as well as with the States of Maryland and New York; the concepts outlined in the modernization report are being used in these pilot studies.

ACRONYMS USED IN THIS DOCUMENT

BFE	Base Flood Elevation
CTC	Cooperating Technical Community
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
ERM	Elevation Reference Mark
FEMA	Federal Emergency Management Agency
FIS	Flood Insurance Study
GPS	Global Positioning System
LOMA	Letter of Map Amendment
LOMR	Letter of Map Revision
LOMR-F	Letter of Map Revision - based on Fill
LOMC	Letter of Map Change
MNUSS	Map Needs Update Support System
MSC	Map Service Center
NAVD 88	North American Vertical Datum of 1988
NFIP	National Flood Insurance Program
NGS	National Geodetic Survey
NGVD 29	National Geodetic Vertical Datum of 1929
TEC	Technical Evaluation Contractor
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

1. FEMA's Flood Hazard Mapping Program–Where We've Been, Where We Are, and Where We're Going

Overview

- Approximately 100,000 flood hazard map panels have been produced in support of the National Flood Insurance Program (NFIP) since its inception in 1968. The uses of the maps have grown to include not only flood insurance and floodplain management, but also disaster activities, risk assessment, and mitigation.

- Only one user group pays to prepare and maintain the maps. Present funding comes primarily (95%) from a $30 annual fee paid by policyholders. Demands and needs from the broadened user base have significantly outgrown available funding.

- A modernization plan that utilizes state-of-the-art engineering, mapping, information management, and communication technologies has been devised. This plan supports FEMA's strategic goals and the *Disaster-Resistant Communities* initiative.

FEMA has embraced as its vision a national emergency management system built on a partnership of local, state, and Federal governments, voluntary agencies, business and industry, and individual citizens focused on saving lives and property and reducing the effects of disasters regardless of their cause. To realize this vision, three strategic goals have been adopted:

1. Protect lives and prevent the loss of property from all hazards.

2. Reduce human suffering and enhance the recovery of communities after disaster strikes.

3. Ensure that FEMA serves the public in a timely and cost-efficient manner.

The first step in protecting lives and preventing losses due to floods is identifying the location and severity of the flood hazard. This information can then be used to develop comprehensive and effective flood loss reduction measures to help communities reduce their vulnerability to floods, and, thus, proactively reduce human suffering from floods when they occur.

The Mitigation Directorate administers FEMA's Flood Hazard Mapping Program. In this document, the Directorate surveys the current uses for, and challenges facing, the mapping program and presents its plan for an efficient transition to the electronic age to fulfill the demands and the needs of the diverse user groups. This plan will help FEMA achieve its three strategic goals, as well as the primary goals of the *National Mitigation Strategy*. In addition, the maps will play a key role in the *Disaster-Resistant Communities* initiative because they are essential elements in the risk assessment activities that participating communities must practice.

Since its inception in 1968, the NFIP has been engaged in a massive and unprecedented task–a nationwide assessment of flood hazards. The accomplishments are impressive! Over 100,000 map panels have been produced for nearly 19,000 communities. The net effect of this work is that it has protected citizens' lives, properties, and personal finances by providing an insurance mechanism for those at risk and flood hazard data to minimize the flood risk for new development.

As the uses and applications of the maps have grown over the years, FEMA's Flood Hazard Maps have evolved in response to user needs and improved technologies, but their production has always taken place within real-world fiscal constraints. Newer digital cartographic techniques are often more cost effective, in both the short- and long-term, than the old manual techniques when updating or creating flood hazard maps. However, the conversion of over 100,000 existing map panels to a digital format has been, by design, deliberate and methodical, and, because of funding constraints, generally has occurred only when new or updated flood hazard information has required an update to a community's flood hazard maps or in support of some disaster response activities. As mapping technologies, the applications and uses for the maps, and the NFIP map users become increasingly sophisticated, FEMA's Flood Hazard Maps must also continue to evolve.

The flood hazard mapping program is now at a critical juncture. To fulfill the ultimate mission of accurately identifying all the nation's flood hazards and also of educating and alerting the public to the risks of flooding, challenges must be met. Technology offers a powerful tool to meet these challenges. However, FEMA, like much of private industry, is in a transition phase in that the capability of its customers to use electronic information varies from state-of-the-art to none at all. Therefore, as the flood hazard mapping program enters the electronic age, the transition must be planned to satisfy the diverse needs of all its customers.

The cornerstones of the plan to modernize FEMA's Flood Hazard Mapping Program are to use state-of-the-art technology to cost-effectively:

- develop accurate and complete flood hazard information for the entire nation;
- provide that information in a readily available, easy-to-use format; and
- alert and educate the public regarding the risks of flood hazards.

As a result of this plan, state and community officials, property owners, and others will be made more aware of flood hazards nationwide. It is, therefore, likely that more flood insurance policies will be sold and safer communities will be built. Thus, the plan will reduce the burden on the general taxpayer for disaster relief and maintain the maps as one of the most valuable national resources for flood hazard mitigation.

Users of FEMA's Flood Hazard Maps

The flood hazard maps are referred to for each of the 15 million mortgage transactions each year and every time a community issues a building permit. Although originally developed to support the flood insurance and floodplain management activities associated with the NFIP, the maps are currently used by no fewer than 9 distinct constituencies for a variety of applications, including disaster preparedness, response, and recovery; risk assessment; and diverse mitigation activities. Unfortunately, the program continues to be funded almost exclusively by flood insurance policyholders. Currently, the maps are used by:

- **insurance companies and agents** to determine actuarial rates for flood insurance policies;
- **lenders** to determine the flood risk status of mortgage properties at loan origination and throughout the life of the mortgages;
- **real estate professionals and property owners** to determine the flood risk status of properties;

- **flood map determination firms** to specify the location of properties relative to the flood hazard area;
- **floodplain managers/community planners** to establish and enforce minimum land use and construction ordinances that comply with minimum NFIP standards;
- **the land development industry** to aid in designing developments that will be safe from flood hazards;
- **surveyors** to prepare elevation certificates for structures;
- **engineers** to consider the flood risk when designing flood mitigation projects, such as structure elevation and relocation, buyouts, and culvert replacements; and
- **disaster and emergency response officials** to prepare for flooding disasters and issue warnings to those in danger of flooding and, after a flood has occurred, to implement emergency response activities and to aid in the rebuild and reconstruction phase.

Funding for FEMA's Flood Hazard Mapping Program

Approximately $1.2 billion ($2.7 billion in 1997 dollars) have been spent to date with $339 million ($828 million in 1997 dollars) appropriated in the 4-year period beginning in Fiscal Year 1976 and ending in Fiscal Year 1979. During this period, the majority of detailed flood hazard studies were conducted. By Fiscal Year 1985, annual funding and expenditures for flood hazard mapping had dropped to a level slightly above the appropriated funds of the early 1970s and remained at a consistent level until Fiscal Year 1994. Over the past 3 fiscal years, the funding has increased somewhat, primarily because of the increase in flood insurance policy sales.

Presently, funding for FEMA's Flood Hazard Mapping Program comes primarily from a $30 Federal Policy Fee charged to each flood insurance policy. The only other source of funding for mapping comes from a fee charge system for reviewing and processing map revision requests and for printing and distributing the maps and engineering backup data. The fee charge system accounts for approximately 5% of the funding for the mapping program; the remaining 95% comes from the Federal Policy Fee, which also pays for other activities including floodplain management and flood mitigation assistance. Funding for Fiscal Year 1997 was approximately $46 million, and the demand from the broadened user base for map products has significantly outgrown available funding.

Modernizing FEMA's Flood Hazard Mapping Program

The present funding constraints limit the program's ability to satisfy customers' demands and fulfill FEMA's mission of providing accurate, up-to-date flood hazard mapping. Limitations are apparent in four broad areas:

- map accuracy and completeness,
- map utility,
- map production, and
- public awareness and customer service.

In response to these limitations and user demands, a plan for modernizing the mapping program has been designed. The plan builds on currently successful processes and products; however, it incorporates the use of new technologies that will provide greater accuracy and also tend to be faster and more cost effective. Features of this plan include:

- focused efforts to improve study and mapping methodologies and, in turn, enhance the accuracy and completeness of the maps;

- a 7-year program to convert the mapping inventory to a digital format through new digital mapping products, including the flagship Digital Flood Insurance Rate Map 2.1 (DFIRM 2.1) and its building block DFIRM 2.0 (see discussion on the following page);

- improved map production and update processes for producing the DFIRM 2.0 and 2.1 products; and

- improved outreach and customer service, including improved distribution methods to facilitate the awareness of, and protection against, flood risks.

A key element of this modernization plan will be greatly expanded use of the World Wide Web via the Internet. The long-term goal is for all FEMA's Flood Hazard Maps and mapping-related products to be available via the Internet. In addition, the Internet will be key to providing public awareness and education campaigns and enhancing customer service.

The plan also includes the conversion of the flood hazard maps to the metric system and the North American Vertical Datum of 1988 (NAVD 88).

The Next Generation of FEMA Digital Mapping Products

The proposed new digital FEMA Flood Hazard Maps, **DFIRM 2.0** and **2.1**, will:

- build on existing digital mapping products (DFIRMs and Q3 Flood Data) but contain all the information shown on the printed maps–including the base map;
- be distributed in both paper and digital versions–either version will serve as the regulatory document;
- support modern printing methods (color printing may be used); and
- be distributed on CD-ROM and, eventually, via the Internet.

DFIRM 2.0 and **2.1** will look the same and have equal standing in the program. The primary differences are:

DFIRM 2.0 will:

- be prepared for communities with adequate flood data but inadequate base maps–no new significant engineering work will be required; and
- provide for cost-efficient, rapid conversion of the mapping inventory to a digital format and serve as a transition to DFIRM 2.1.

DFIRM 2.1 will:

- be prepared when conducting flood data updates, which require engineering analyses and, thus, will be more costly to develop than DFIRM 2.0;
- allow integration of mapping and engineering data and subsequent addition of other features, if mandated, such as erosion hazard zones; and
- include a Flood Hazard Report containing engineering data to replace the existing Flood Insurance Study (FIS) report.

The priorities and initiatives, both short- and long-term, developed to implement the plan are presented in Sections 2 through 6.

Section 7 outlines the ongoing and next steps to be taken in implementing the plan. These steps include a benefit/cost analysis; developing the needed product specifications, procedures, and management structure; coordination with map user groups for their assistance in prioritizing the recommendations; and several pilot studies implementing the concepts outlined in this report.

2. Map Accuracy and Completeness

Overview

To develop accurate and complete flood hazard information for the entire nation:

- Flood data updates will be conducted for approximately 25,000 existing map panels.
- Updated maps will be prepared for approximately 40,000 existing map panels with adequate flood hazard information but inadequate reference features, such as roads.
- Flood hazard data will be developed and approximately 13,700 new flood hazard map panels prepared for an estimated 2,740 flood-prone communities without flood hazard maps.
- A procedure for evaluating the accuracy of the flood hazard maps after Presidentially declared disasters will be implemented.

Providing communities with accurate, up-to-date, and complete flood hazard information is a fundamental tenet of FEMA's Flood Hazard Mapping Program. All users rely on the maps to be accurate and complete. Although existing technology allows for a high degree of accuracy, fiscal constraints limit the accuracy of all maps, including the flood hazard maps. Nevertheless, improving the accuracy of the maps is not only possible with existing technologies, but necessary given present user demands. Similarly, improving the completeness of the flood hazard information on the maps is necessary because there are flood-prone areas throughout the nation that are not presently identified on flood hazard maps.

This section quantifies the current needs for accuracy and completeness of flood hazard mapping and summarizes the planned initiatives for improving the accuracy and completeness of the maps.

Five-Year Map Update Needs Assessment

With the National Flood Insurance Reform Act of 1994, Congress mandated that the flood hazard map for each community be evaluated for update needs at least once every 5 years. Therefore, the Five-Year Map Update Needs Assessment process was developed to provide an inventory of the FEMA Flood Hazard Maps in need of updating. The evaluation process includes soliciting input directly from the communities, the state NFIP coordinating agency, FEMA Regional offices, and the archives of backup mapping data where flood map deficiencies are documented.

For purposes of the assessment process, communities are classified in three categories:

(1) those whose maps require flood data updates by study contractors to identify areas subject to flooding or to correct existing floodplain boundaries shown on the maps;
(2) those whose maps require maintenance only; and
(3) those whose maps have no flood data update or maintenance needs.

Map maintenance needs relate to base map information, mismatches with the maps of neighboring communities, Elevation Reference Marks (ERMs), and corporate limits.

As communities are evaluated, the results are entered into the Map Needs Update Support System (MNUSS) software application. This software ranks and prioritizes the map update needs based on a benefit-cost approach. The final rankings are used to establish the list of map updates to initiate in the coming fiscal year.

By the end of Fiscal Year 1997, the first 30% of communities in the NFIP will be screened and evaluated, and the information on map update needs will be entered into the MNUSS. By the end of Fiscal Year 1999, the screening and evaluation of the remaining 70% of communities will be complete, providing a national inventory of flood hazard mapping needs. The inventory will then be maintained continuously and updated on a real-time basis to ensure that newly identified needs are entered and that actions taken to address needs are properly recorded.

Table 1 summarizes the estimated mapping needs of the flood hazard mapping inventory based on data collected through June 1997. This screening included contacting 10% of the communities participating in the NFIP. The estimated needs will change as greater numbers of communities are contacted.

Table 1. Summary of Map Update Needs

Estimated Map Panels	Mapping Need
25,000	Flood Data Update
40,000	Map Maintenance
35,000	Require No Revisions
13,700	Flood-Prone Communities without FEMA Flood Hazard Maps

To address the accuracy and completeness needs of the flood hazard maps, initiatives are planned in four areas: ***Flood Data Updates; Map Maintenance; Communities without FEMA Flood Hazard Maps;*** and ***Post-Flooding Disaster Hazard Verification.*** These initiatives are discussed in detail in the following sections.

Flood Data Updates

Recommendation

Conduct flood data updates for approximately 25,000 existing map panels. New minimum standards for topographic mapping used to delineate floodplain boundaries in conducting flood data updates will be developed. Also, emphasis will be placed on developing detailed flood hazard information for approximate Zone A areas and unidentified floodplains.

Time Frame: Conduct engineering studies and prepare updated maps between Fiscal Years 1999 and 2005.

Flood data updates for a community can be necessitated for a variety of reasons, including:

- physical conditions (manmade and natural) within the watershed and/or floodplain have changed;
- the level of existing or anticipated development requires more detailed level of analysis and/or mapping to allow for more accurate flood insurance rating and floodplain management;
- improved study and mapping methods have been developed; and
- more detailed, up-to-date information, such as historical flood data, is available.

Flood data update needs are addressed primarily through field reconnaissance, engineering studies, and floodplain mapping conducted by FEMA-hired, local study contractors. As indicated in Table 1, approximately 25,000 existing map panels need flood data updates. Therefore, updated engineering studies will be conducted and floodplain mapping developed for these map panels between Fiscal Years 1999 and 2005.

In conducting these flood data updates, state-of-the-art engineering and mapping technologies will be utilized. Emphasis will be placed on *improving the flood hazard analyses, improving the accuracy of floodplain boundaries,* and *developing detailed flood hazard data for approximately studied and unidentified floodplains.*

Improved Flood Hazard Analyses

In conducting flood studies, flood elevations are computed by using field and historical data to conduct engineering analyses. The majority of engineering analyses for flood hazard studies are conducted using computer models. For example, the U.S. Army Corps of Engineers (USACE) HEC-1 and HEC-2 models and similarly capable models developed by the U.S. Geological Survey (USGS) and the Natural Resources Conservation Service (formerly the Soil Conservation Service) have been used in conducting FEMA flood studies for tens of thousands of stream miles. In general, flood studies conducted using these models have proven reliable. However, improved computer technology has resulted in the development of many new and innovative engineering computer programs designed to model a wide variety of complex flooding situations, such as the interconnected channels and ponds in the flat terrain of Florida.

Another innovation in recent years in conducting flood hazard studies is the integration of digital topographic data, referred to as Digital Elevation Models (DEMs), with the engineering modeling. This integrated approach leads to more cost-efficient, accurate, and easy-to-update flood studies and has been used successfully for studies where the extent of the study area made use of this technology feasible. In the future, it is envisioned that this will become the standard method of conducting flood hazard studies.

The following steps will be taken to utilize state-of-the-art flood hazard analysis methodologies and improve the accuracy of the flood hazard maps:

- Pursue integrated engineering modeling and DEMs in conducting flood hazard data updates whenever feasible. Example statements of work will be developed for establishing study scopes using such an approach.

- Implement a systematic conversion from existing engineering models, such as HEC-1 and HEC-2 to the USACE's next generation of software, HEC-NEXGEN, in the flood hazard data update processes.

- Develop standards, general guidance, and privacy agreements for reviewing and accepting privately developed methodologies for FEMA Flood Hazard Mapping purposes.

- Evaluate and improve coastal flood hazard analysis and mapping methodologies.

Improved Accuracy of Floodplain Boundaries

Floodplain boundaries are delineated using the computed flood elevations resulting from the engineering analyses in conjunction with topographic mapping. In conducting flood hazard studies, the most accurate and up-to-date topographic map available is typically used. Commonly used mapping sources include USGS topographic quadrangle maps, as well as community-developed topographic maps. USGS topographic quadrangle maps are typically prepared at a scale of 1:24,000 with contour intervals (lines of equal elevation) of 5, 10, 20, or 40 feet.

There are inherent limitations of the accuracy of the floodplain boundaries because of limitations of the source topographic data; therefore, structures near the edge of floodplains may be erroneously excluded or inadvertently included in the floodplains shown on the flood hazard map. This can cause structures located physically outside the mapped floodplain to be subjected to floodplain management regulations and the mandatory purchase requirements or, even worse, structures actually located in the floodplain not to be subjected to these requirements, which is potentially devastating to the property owner. These structures that should be included in the floodplain, but are not, result in increased losses to the nation's taxpayers because there is no insurance mechanism to offset some of the disaster assistance expenditures when a flood occurs.

The topographic mapping commonly available for use in conducting flood studies varies significantly in terms of quality, accuracy, and detail. When an acceptable source is not available, FEMA normally develops topographic mapping of the flooding source and adjacent areas. Although developing such mapping increases the cost of conducting the study, the need for greater accuracy is imperative and improved aerial mapping and surveying techniques and technologies make it possible.

New minimum standards for topographic mapping used in conducting flood data updates will be developed. These standards will include:

- standard operating procedure requiring an up-front search for, and evaluation of, available topographic mapping from all potential sources including the community, state, and other Federal agencies, such as the USGS;

- a decision-making process to select the most accurate, up-to-date source (the availability of this information in, or the ability to convert this information to, a digital format will be part of this decision-making process); and

- when an available source meeting the minimum standards is not available, development and integration into the engineering analyses of a DEM as part of the flood data update. Example statements of work will be developed for use in developing the scope of flood data updates.

Approximately Studied and Unidentified Floodplains

Sound, prudent development in flood-prone areas requires the availability of accurate, detailed flood hazard data prior to construction so that the risk of flooding to both the new and existing structures will be minimized. However, many delineations of flood-prone areas throughout the U.S. are based on approximate methods of analysis rather than on detailed engineering analyses. Additionally, there are

flood-prone areas that are not identified as flood prone on the flood hazard maps. These approximately studied and unidentified flood-prone areas contribute to escalating costs for Federal disaster assistance resulting from poor floodplain management decisions and uninsured property owners.

There is presently no readily available method to quantify the national extent of approximately studied areas (designated as Zone A on flood hazard maps), but estimates are that they represent approximately one-half to two-thirds of the floodplains identified through FEMA's Flood Hazard Mapping Program.

The majority of the approximate floodplains date from the early phases of the NFIP when the mapping inventory was being built and the critical motivation was to develop flood hazard maps for thousands of communities across the nation as quickly as possible so that they could join the NFIP. The intention was to conduct detailed engineering analyses where existing or anticipated development levels justified doing so in the next phase of the mapping program.

However, many areas had minimal or no development, and detailed studies could not be justified in the benefit-cost approach used to prioritize the disbursement of the flood hazard mapping budget. Now, many of these areas are being developed, and, thus, the approximate floodplain designation is no longer adequate.

The approximate floodplain designation can result in significant problems when development begins to occur. Although the estimated area of flooding inundation is shown on the map, Base (1% annual chance) Flood Elevations (BFEs) are not. Often, communities do not have the technical expertise or strong enough regulations to require development of detailed flood hazard information. Without detailed information, new structures may be built in floodplains without appropriate consideration of flood risk.

The implications of the approximate floodplain designation are also significant for property owners. In order to ascertain appropriate risk information for insurance rating or purchase, property owners may be required to hire, at their own expense, a professional engineer to perform the necessary computations.

Finally, the approximate floodplain designation results in a drain on the flood hazard mapping budget. The inherent uncertainty of the approximate floodplains increases the volume and the complexity of map amendment and revision requests. Approximately one-third of all map amendment and revision requests are for Zone A areas and typically take longer and are more costly to review than requests along flooding sources where BFEs have been specified.

In addition to approximately studied floodplains, there are areas that are not identified as being flood prone although they actually are. These unstudied areas are not designated as flood prone primarily because at the time the original study was conducted either

- it was perceived, incorrectly, that a threat from flood hazards did not exist, or
- the area adjacent to the flooding source was undeveloped or minimally developed and no development was planned for the area.

Problems in unstudied flood-prone areas are similar to those for approximately studied floodplains. Additionally, it is likely that most property owners in these areas will not purchase flood insurance voluntarily, and lending institutions will not require them to purchase the insurance; thus, these property owners and their lending institutions will not have financial protection when a flood occurs.

To address the concerns with the approximate and unidentified floodplain areas, the following actions are planned:

- Develop a national inventory of Zone A areas to aid study initiation priorities as part of the DFIRM 2.0 and 2.1 production processes (discussed in Section 3).
- Identify developing Zone A and unidentified but flood-prone areas as flood data update needs as part of the Five-Year Map Update Needs Assessment using a 20-year planning horizon.
- Implement as the standard procedure that the study contractor will evaluate Zone A areas shown on the effective map in consultation with the community and include detailed study of those flooding sources, where appropriate, when initiating a FEMA-funded flood data update.
- Establish cooperative agreements with states and communities (discussed in Section 4) encouraging them to study these areas.
- Provide technical support through existing contract mechanisms to make site-specific BFE determinations.
- Pursue a direct mailing of the FEMA publication Managing Floodplain Development in Approximate Zone A Areas: A Guide for Obtaining and Developing Base (100-Year) Flood Elevations to communities with all or a significant amount of their identified flood-prone areas designated as Zone A. The mailing will include guidance and procedures for the community to follow to develop BFEs for Zone A areas and pursue flood hazard map revision requests.

Map Maintenance

Recommendation

Prepare updated maps resolving the map maintenance needs for approximately 40,000 existing map panels. New base map and ERM standards will be developed.

Time Frame: Prepare updated maps between Fiscal Years 1999 and 2003.

As indicated in Table 1, there are approximately 40,000 flood hazard map panels nationwide in need of map maintenance. Map maintenance needs typically affect base information, such as roads, streets, streamline locations, political boundaries, and ERMs. Historically, map maintenance needs have not been properly recognized as valid mapping needs, and the limited funding available for the mapping program has been spent on conducting flood data updates. However, the accuracy of the base information directly impacts all flood zone assessments based on the flood hazard maps and is, therefore, crucial. Therefore, updated maps resolving the map maintenance needs for the approximately 40,000 existing map panels will be prepared between Fiscal Years 1999 and 2003. In preparing the updated maps, emphasis will be placed on base maps and ERMs.

Base Maps

The base map covers the entire geographical area of the community and is used as the source for physical features–most notably roads and road names, railroads and names, streams, corporate limits and section lines–on the flood hazard maps. These features are utilized by map users to locate properties and structures relative to floodplains. For both digitally and manually produced maps, a search is conducted at the beginning of the production of a flood hazard map for the most accurate and up-to-date base mapping sources at the Federal, state, regional, and local levels. If provided, local base maps are evaluated for

currency, accuracy, and extent of coverage prior to use for FEMA Flood Hazard Mapping. For manually produced flood hazard maps, the USGS 7.5-Minute series topographic quadrangle maps are the most common base map source primarily because they provide large scale accuracy and national coverage. The USGS 1:24,000 scale Digital Line Graphs, the digital version of the 7.5-minute quadrangle maps, and locally developed base maps are the most common base mapping sources for producing digital flood hazard maps. The lack of adequate digital base mapping on a nationwide basis has been a hindrance to FEMA's digital conversion efforts to date.

The primary base map factors contributing to the accuracy of flood hazard maps are the currency of the source material and the horizontal accuracy. Approximately 45% of the maps are 10 years or older; 70% are 5 years or older. In many communities, significant development has occurred in the years since their flood hazard maps were prepared. The result is that often roads and streets in newer subdivisions, essential reference points when making flood zone determinations, are not shown on the flood hazard maps.

The current preference is to use a local, state, or regional base map in preparing flood hazard maps, when possible, because that is the map with which the community is familiar. However, in preparing flood hazard maps for an entire county, it is frequently necessary to combine base maps from various sources to provide complete geographic coverage. Because the various base maps differ in scale, data collection, and mapping methods, their accuracy also varies.

Further, many communities do not have accurate digital base map data, and, when they do, there are often proprietary and licensing issues when using a locally developed digital base map. In the past, FEMA has signed licensing agreements with communities agreeing not to distribute the base map. However, to fulfill the needs of digital map users, base map source material(s) must be distributed with the DFIRM 2.0 and 2.1 products.

To improve the accuracy of base maps used to prepare the flood hazard maps, the following actions will be necessary:

- Develop base mapping source standards that include considerations regarding data accuracy (such as horizontal position and scale), currency, community concurrence, content, and data distribution. These standards will require the use of the most accurate and current Federal base map, when a local, state, or regional base map meeting the base mapping source standards is not available.

- Develop graphics specifications for depicting base map information on the DFIRM 2.0 and 2.1 products.

- Develop and maintain a base mapping source database as part of the Five-Year Map Update Needs Assessment. This effort will be coordinated with the current Federal Geographic Data Committee effort to put in place a geospatial data clearinghouse.

- Develop format specifications for distributing base map data in a format complying with Federal standards for digital data.

- Pursue partnering with other Federal, state, and local agencies to develop base map source data.

The necessary standards will be developed in Fiscal Year 1998 and implemented beginning with Fiscal Year 1999 procurements.

Elevation Reference Marks

ERMs are vertical reference points located in the field that are used for establishing elevation information in conducting and using flood hazard studies. The descriptions, locations, and elevations for these ERMs are provided for informational purposes on the published flood hazard maps. These ERMs are often used by surveyors and engineers in the field to establish property and structure elevations, which are used in conjunction with the flood hazard information depicted on the map to make flood insurance and floodplain management decisions.

The majority of the ERMs on the flood hazard maps were determined using conventional surveying techniques. In the years since the studies were conducted, many of these ERMs have been destroyed, subsided, suffered disturbance, or otherwise cannot be located. This leads to obvious problems for surveyors who try to locate and use these ERMs.

The emergence of Global Positioning System (GPS) technology, which utilizes Department of Defense satellites in conjunction with land-based receiving units operated by field survey crews, allows for many of these problems to be overcome. Over large areas, GPS surveying techniques are more accurate than conventional surveys and require fewer benchmarks, thus eliminating the need to establish temporary benchmarks for ERMs.

The long-term goal will be for FEMA to cease publishing ERM information on the flood hazard maps. Rather, map users will be referred to the National Geodetic Survey (NGS) for the latest benchmark information. The NGS is the Operational Unit of the National Ocean Service of the National Oceanic and Atmospheric Administration that develops and maintains the National Spatial Reference System. This system includes a national network of approximately 580,000 accurate benchmarks determined using geodetic surveying, photogrammetric, and remote sensing techniques. Data on these benchmarks are updated continuously as survey data are compiled. This information is published monthly on CD-ROM and is available and updated daily on the NGS web site.

In Fiscal Year 1998, the need to continue publishing ERM information with the FEMA Flood Hazard Maps on an interim or short-term basis will be explored with professional surveying organizations, such as the American Congress on Surveying and Mapping. New specifications will be developed for ERMs in Fiscal Year 1998 and implemented with Fiscal Year 1999 procurements.

Communities Without FEMA Flood Hazard Maps

Recommendation

Complete a national inventory of unmapped communities, conduct engineering analyses and floodplain mapping, and prepare flood hazard maps for all flood-prone, but unmapped, communities and tribal nations.

Time Frame: Complete investigations and develop prioritized ranking in Fiscal Year 1998. Conduct analyses and prepare mapping between Fiscal Years 1999 and 2005.

For a variety of reasons, there remain communities and tribal nations throughout the U.S. that do not have FEMA Flood Hazard Maps. These reasons include the following:

- minimal or nonexistent flood risk, development, and/or development potential;
- reluctance or lack of interest by the community to participate in the NFIP;
- limited funding for the flood hazard mapping program; and/or
- additional demands and emphasis placed on FEMA by the U.S. Congress for maintaining and updating existing maps rather than creating new maps.

The lack of a FEMA Flood Hazard Map for a community creates significant problems–for the community, its residents, and lending institutions. Based on data available as of June 1997, there are approximately 6,090 communities without FEMA Flood Hazard Maps. It is estimated that for approximately 3,350 of these communities, flood hazard maps will not need to be created because they are minimally or non flood prone, already shown on an effective map for the adjacent or surrounding county or community, or presently have mapping underway as part of an ongoing action. However, it is anticipated that flood hazard maps should be prepared for the remaining 2,740 communities that are indeed flood prone and have development and/or development potential. As indicated in Table 1, it is estimated that this will require the creation of 13,700 flood hazard map panels.

Therefore, detailed investigations into the flooding vulnerability, mapping status, and availability of flood hazard data will be conducted in Fiscal Year 1998 for communities without flood hazard maps for all 50 states. Upon completion of the investigations, mapping options, funding requirements, and prioritized ranking for all communities without flood hazard maps will be developed. Engineering analyses will then be conducted and floodplain mapping developed between Fiscal Years 1999 and 2005 for all flood-prone, but unmapped, communities and tribal nations.

Post-Flooding Disaster Hazard Verification

Recommendation

Develop and implement a Standard Operating Procedure for verifying and, if warranted, revising the flood hazard maps in the post-flooding disaster response.

Time Frame: Develop Standard Operating Procedure in Fiscal Year 1998. Implement beginning with Fiscal Year 1999 flooding disasters.

Data gathered in the aftermath of flooding disasters can be used to evaluate the accuracy of the FEMA Flood Hazard Maps and to plan for and mitigate against future floods. Although efforts have been made in recent years to conduct such post-flooding disaster studies, there is no uniform nationwide procedure for doing so, and the efforts are often not allocated the proper funding or resources.

Current, accurate flood hazard information is key in guiding reconstruction after a flood. In fact, the Stafford Act mandates that the actual hazard be identified prior to the issuance of grant money for reconstruction in a hazard area. Benefits and uses of the field verification and updated flood hazard maps beyond the flood hazard mapping program include:

- providing information to perform cost-benefit analyses for infrastructure hazard mitigation alternatives and for Section 404 Hazard Mitigation projects;

- providing information regarding the true causes of flooding and solutions available, which must be used to evaluate proposed Section 404 and 406 hazard mitigation alternatives (such as relocation and elevation of insurable structures); and
- resolving NFIP compliance issues related to or following a disaster event.

Therefore, a Standard Operating Procedure for verifying and, if warranted, revising the flood hazard maps after Presidentially declared flooding disasters will be developed in Fiscal Year 1998 and implemented in Fiscal Year 1999. Because of the benefits outside the mapping program, it is appropriate that this task be funded by direct appropriations or from Stafford Act Disaster Funding rather than by funding from the flood hazard mapping budget.

3. Map Utility

Overview

To support automated applications by map users, and modern printing and distribution methods, and reduce the unit costs of map production and revisions, a 7-year program to convert the flood hazard mapping inventory to a digital format will be initiated in Fiscal Year 1999. Features of this digital conversion program include:

- Two new digital mapping products **DFIRM 2.0–**to be prepared when addressing map maintenance needs–and **DFIRM 2.1–**to be prepared when developing or updating flood data; and

- Integration of this digitization program with the flood data updates, map maintenance, and preparation of new maps for unmapped flood-prone communities discussed in Section 2.

Nearly all of the 100,000 existing map panels in the flood hazard mapping inventory were initially prepared using manual cartographic techniques. These techniques were state-of-the-art at the time the inventory was being built. However, the manual format limits the utility of the maps for risk assessment, modern distribution methods, and cost-effective revisions. Digital production would resolve many of these limitations. To date, it has not been possible to convert the entire mapping inventory to a digital format. Because of funding constraints, maps have been converted, in general, only when new flood hazard data have been generated for a community or for disaster applications.

Many flood hazard map users require digital data for disaster response and recovery activities, both proactive and reactive; flood insurance activities; repetitive loss investigations; elevation certification; natural hazards assessments; floodplain management; planning, zoning and permitting; map determinations; map production; and risk assessment. Increasing numbers of regional, county, and local governmental entities now have digital mapping capabilities to support more effective floodplain management and preparedness programs. While it is unlikely that the paper maps will disappear in the foreseeable future, their content, format, production, and distribution will be driven by a digital environment capable of supporting multiple data uses.

The efforts to address the accuracy needs of the flood hazard maps (discussed in Section 2) will be integrated into a 7-year program to digitize the flood hazard maps. This section overviews the plan for this digital conversion, which will involve a transitional product–the DFIRM 2.0–and a more robust DFIRM 2.1.

Recommendation

DFIRM 2.0 will be prepared for the estimated existing 40,000 map panels with map maintenance needs.

Time Frame: Develop product specifications in Fiscal Year 1998. Digitize maps and print and distribute the updated maps between Fiscal Years 1999 and 2003.

A significant initiative in 1995 and 1996 was the development and production of Q3 Flood Data for over 895 counties nationwide. The Q3 Flood Data product has supported insurance policy marketing initiatives and has been used in hazard analyses, risk assessment, and floodplain management activities. While the product was well received by the user community, it has several limitations. These are that it does not serve as the regulatory document, does not contain a base map, and does not contain certain key information, such as BFEs and, in some cases, floodways. For these reasons, the Q3 Flood Data product cannot be used for flood zone determinations. The newer product, DFIRM 2.0, will use the existing Q3 Flood Data inventory as a building block to allow for the rapid digital conversion of the flood hazard maps; however, it will include more information, such as BFEs and floodways, and will serve as the regulatory document.

DFIRM 2.0 will be developed for the estimated 40,000 map panels that have adequate floodplain mapping but outdated or inaccurate base maps. The DFIRM 2.0 will be phased out as communities requiring a flood data update are converted to DFIRM 2.1. To facilitate this conversion, DFIRM 2.0 will have specifications similar to those of the DFIRM 2.1, allowing a community that has an existing DFIRM 2.0 to be more easily converted to a DFIRM 2.1, should a flood data update be required in the future.

In contrast to the DFIRM 2.1 product, minimal engineering will be performed in DFIRM 2.0 production. Mismatches between existing map panels within a community will be resolved. However, discrepancies between communities caused by inconsistencies in flood hazard analyses will not be resolved, but will be identified in the MNUSS for resolution and/or flood data update at a later date.

New specifications for the DFIRM 2.0 will be developed in Fiscal Year 1998 and new digital maps prepared beginning in Fiscal Year 1999. Options to be considered for these specifications include:

- providing information that is currently shown in the title block in a read-me file;
- encoding road names to allow for a look-up tool;
- encoding the BFEs and cross sections with elevations;
- encoding the floodways; and
- scanning the FIS report and flood profiles.

Recommendation

DFIRM 2.1 will be prepared for the estimated existing 25,000 map panels with flood data update needs and 13,700 panels to be created for an estimated 2,740 flood prone, but unmapped, communities.

Time Frame: Develop product specifications in Fiscal Year 1998. Conduct flood data updates, digitize maps, print, and distribute the updated maps between Fiscal Years 1999 and 2005.

The DFIRM 2.1 product will be an advance over the current DFIRM product and the new DFIRM 2.0. It will be an engineered product that reflects new analyses and mapping of flood hazards developed by a study contractor hired by FEMA to resolve flood data update needs for an estimated 25,000 map panels in need of flood data updates. Further, in preparing the DFIRM 2.1, discrepancies between communities due to inconsistencies between floodplain analyses will be resolved. Besides the engineering work, the DFIRM 2.1 will incorporate additional attributes and features, such as the on-line integration of engineering data.

New specifications for the DFIRM 2.1, which will be designed to take advantage of DFIRM 2.0 as well as FEMA's current inventory of digital mapping products (DFIRMs and Q3 Flood Data) will be developed in Fiscal Year 1998. These specifications will:

- build on the DFIRM 2.0;
- accommodate additional features and attributes that will allow the on-line integration of the engineering modeling data with the mapping data;
- allow for the subsequent addition of features and attributes, such as erosion hazard zones, historic shorelines, or other hazards such as dam-break inundation areas; and
- include development and integration of a Flood Hazard Report, containing engineering data important for floodplain management, to replace the existing FIS report.

Integration of DFIRM 2.0 and 2.1

To ensure an efficient digital conversion of the mapping inventory, the DFIRM 2.0 and 2.1 will have compatible digital data specifications and will utilize an identical family of acceptable and prioritized base maps (in accordance with the new base map specifications to be developed as discussed in Section 2). They will also have the following common features:

- To allow the products to serve as the regulatory documents for flood insurance and floodplain management and to allow for consistent flood zone determinations, the base map will be distributed with both the DFIRM 2.0 and 2.1, both hard and soft copies.

- The digital copies will be distributed on CD-ROM and, in the long term, via the Internet through the Map Service Center (MSC) web site. The format of the digital copies will comply with Federal guidelines (Executive Order 12906) for the transfer of digital spatial data.

- For printing of hard copies, these new digital mapping products will support future requirements of the Government Printing Office to print from an electronic file rather than from a Mylar original, as well as the MSC's future publish-on-demand requirements (discussed in Section 5).

- The horizontal and vertical accuracy requirements of the base map (see Section 2) and flood hazard area features will be clearly specified.

- The topological structure of the digital files will be simplified from present digital mapping products, which will decrease production costs.

- In developing the specifications for both DFIRM 2.0 and 2.1, the graphic standards for the portrayal of features will be updated to better utilize database technology and further automate feature labeling.

- Consideration will be given to using color to identify flood themes. The use of color will eliminate the need for some text placement and screens and, thus, make the maps easier to prepare, read, and comprehend.

The primary difference between the DFIRM 2.0 and 2.1 products will be in the level of engineering and data structure used in producing these products. However, the printed versions of the maps will look essentially the same. Because both products will serve as the regulatory document, it is important that end users be provided with a consistent product.

4. Flood Hazard Map Production

Overview

- The process for conducting FEMA-funded flood data updates will be re-engineered to reduce turnaround time and unit costs.
- The processes for reviewing and processing Letter of Map Change (LOMC) requests will be streamlined.
- A Cooperating Technical Community (CTC) program will be implemented to facilitate Federal, state, and local partnerships in the development and maintenance of flood data and the flood hazard maps.

Sections 2 and 3 of this report outlined a plan for addressing the accuracy and completeness of FEMA's Flood Hazard Mapping while converting to a digital inventory. However, to satisfy the needs of the map users, the processes by which the flood hazard maps are created and updated must also be streamlined. Pilot studies currently being conducted indicate that the plan for streamlining the processes will significantly decrease costs and turnaround time. In addition, mapping partnerships with states, communities, and other local entities will be developed and implemented to enhance and supplement these streamlined processes.

The flood hazard maps are created and updated primarily through two processes: FEMA-funded flood data updates and LOMCs. This section overviews the plan for modifying and supplementing these processes.

FEMA-Funded Flood Data Updates

Recommendation

Implement a new multi-year, task-ordered contracting procedure and the re-engineered FEMA-funded flood data update process.

Time Frame: Implement beginning with Fiscal Year 1999 procurements.

The need for new or updated flood hazard information and/or floodplain mapping is assessed for communities through the Five-Year Map Update Needs Assessment. These update needs are then prioritized, annually, according to a benefit-cost approach. Each year, FEMA-funded flood data updates are initiated, within available funding, for those with the highest ranking. As new or updated flood hazard information is generated through the FEMA-funded flood data update process, the flood hazard maps will be converted to the DFIRM 2.1 format, discussed in Section 3. However, the flood data update process itself must be re-engineered for improved efficiency and a more accurate, complete, and useful product.

The average time to complete a FEMA-funded flood data update, from the time the map update need is identified and funding is allocated to the time the new or revised maps take effect, is approximately 58 months. This is not an acceptable time frame. The existing process is linear and has been in place for nearly 25 years. Improvements can be made to take advantage of new technologies and ease of digital communication, which makes up-front coordination easier and faster.

Because of the concerns with the existing process, new procedures for conducting FEMA-funded flood data updates will be developed and implemented beginning with Fiscal Year 1999 procurements. ***These procedures will include multi-year contracts with study contractors for flood data updates, as tasked by the Regional offices; procuring a specific study contractor each time an update is initiated will not be required.*** These revised procedures should reduce the turnaround time from 58 to approximately 33 months. Additionally, this approach should facilitate the long-term development of the capabilities and commitment of the firms performing the updates, thereby resulting in more accurate, cost-effective flood data updates.

The revised process will include:

- Increased coordination between the Regional office, the National office, study contractors, Technical Evaluation Contractors (TECs) (engineering firms under contract to FEMA to review, revise, and prepare flood hazard maps for publication by FEMA), communities, and states by:

    - beginning TEC processing prior to study contractor processing;
    - having the TEC prepare an inventory and summary of effective flood hazard data and identifying possible base and topographic mapping sources and digital flood hazard data up front for study contractor use;
    - requiring interim submittals by the study contractor to the Regional office and the TEC for early detection and correction of engineering and/or mapping problems; and
    - involving the community and state in the review of the proposed scope of work, study methodologies, and base map selection.

- Study contractor submission of the final draft study concurrently to the community and the TEC. The 90-day appeal period will be initiated at that time. Because of prior coordination with the Regional office and the TEC, additional technical review is unnecessary. The likelihood of appeals should also decrease because of increased technical accuracy and coordination with the community.

- Provisions for evaluating and, where necessary, studying and/or revising all approximate Zone A floodplains. A 20-year planning horizon will be used to evaluate the need to study Zone A areas in detail.

- Allow the use of specialty subcontractors (for example, to develop aerial photography or topographic mapping) based on Regional needs.

Additionally, as a possible long-term initiative, consideration will be given to posting proposed and final BFE determinations, Interim Rules, and Final Rules on the Internet, thereby reducing the turnaround time and eliminating the cost of publishing the proposed notice in the newspaper and the Interim and Final Rules in the *Federal Register*. However, such an initiative will require statutory and regulatory changes.

Recommendations

The procedures for reviewing, preparing, and distributing LOMC requests will be streamlined and automated.

Time Frame: Begin developing and implementing changes in Fiscal Year 1998.

Requests from communities and property owners for amendments and revisions to flood hazard maps can be made for several reasons: to remove inadvertently included properties or structures from the floodplain; to correct errors/refine original analysis; and/or to reflect physical modifications (for instance, fill, stream channelization, levees, dams, or culverts). To ensure national consistency and uniformity of flood-hazard mapping, most of these requests are processed by the National office.

There are three general categories of flood hazard map amendments and revisions:

- map amendments based on natural ground conditions, issued by Letters of Map Amendment (LOMAs);
- map revisions based on the placement of earthen fill, issued by Letters of Map Revision - based on Fill (LOMR-Fs); and
- map revisions based on conditions other than fill (such as stream channelization, bridge construction, or more detailed engineering analysis), issued by reprinting or republishing the map, or by less expensive Letters of Map Revision (LOMRs).

Collectively, LOMAs, LOMR-Fs, and LOMRs are referred to as Letters of Map Change (LOMCs). LOMCs allow FEMA to amend or revise the flood hazard map without actually republishing the affected panel. The demand for LOMCs has increased dramatically over the past several years. In fact it is projected that approximately 12,000 LOMC requests will be received in Fiscal Year 1997. There are several causes for this increase, including the Federal Insurance Administration's *Cover America* campaign and heightened lender compliance with mandatory purchase requirements, which have increased the policy base. In turn, the number of protests or challenges to the flood hazard information depicted on the maps has increased. In addition, many communities do not have the resources or technical sophistication to administer a sound floodplain management program; such communities often use the LOMC process as a surrogate for local review, whereby issuance of a local building permit is contingent on the issuance by FEMA of a LOMC.

Requesters and other map users who utilize LOMCs as part of their daily business operations, such as lending institutions and map determination companies, expect FEMA to process LOMC requests faster than the current time frame of approximately 30 days from receipt of all the necessary data to evaluate the request. The primary factors that affect turnaround time in responding to LOMC requests are that:

- Workload volume has outgrown funding; and
- Considerable time and funds are spent working with LOMC requesters to obtain the required technical

support information, such as BFEs for requests in Zone A areas, for incomplete requests.

In addition to the response time frame concerns discussed above, LOMC distribution procedures have not fully utilized digital technologies desired by many of the recipients.

To improve the LOMC products and procedures, the following short-term changes will be implemented:

- Eliminate the technical review for most LOMA and LOMR-F requests submitted by licensed land surveyors and registered professional engineers for properties located in floodplain areas where BFEs have been established and published on the FEMA Flood Hazard Map.

- Implement a new TEC service to calculate approximate BFEs for requests involving Zone A areas, if these BFEs are not provided by the requester.

- Revise the LOMC application and certification forms on the FEMA and MSC web sites to provide appropriate hyperlinks to other FEMA documents (e.g., NFIP Regulations, Guide for Community Officials) to assist requesters in preparing complete submittals.

- Beginning July 1, 1997, FEMA converted the LOMC publication to a CD-ROM format containing scanned versions of all LOMCs issued. A future action will be to post on the MSC web site an index of these LOMCs along with ordering information.

- Produce and distribute digital map attachments for LOMRs.

- Reduce the standard LOMRs to 1 or 2 pages and present all other information in a standard enclosure. This simplification, which was recently implemented for LOMAs and LOMR-Fs, will make the letters more "user friendly" and reduce the time and costs of preparing customized letters.

- Pursue the use of existing technology to fully automate processing (submittal, review, and distribution) of LOMC requests.

The changes will be developed and implemented beginning in Fiscal Year 1998.

In addition, the following long-term changes to the LOMC products and procedures that necessitate regulatory and/or statutory changes will be pursued:

- Delegate the authority to issue LOMAs and LOMR-Fs to the maximum extent possible to qualified, licensed surveyors and professional engineers, and/or other Federal, state, or local agencies. This will require coordination with NFIP stakeholders and changes to NFIP regulations.

- Post proposed and final BFE determinations, Interim Rules, and Final Rules for LOMRs on the Internet, thereby reducing the turnaround time and eliminating the cost of publishing the proposed notice in the newspaper and the Interim and Final Rules in the Federal Register. The changes will require coordination with NFIP stakeholders, and statutory and/or regulatory changes. In addition, post the Congressionally mandated, semi-annual compendium of flood map changes on the Internet.

Recommendation

Implement a CTC Program using standardized agreements with state and local entities to facilitate the development and maintenance of flood hazard data and mapping.

Time Frame: Develop standardized agreements in Fiscal Year 1998. Publicize and begin implementing CTC agreements in Fiscal Year 1999.

Flood hazard mitigation and the NFIP are partnerships between FEMA and communities. Many states, communities, and other local entities, at their own expense, have furthered this partnership in recent years by investing considerable resources in identifying and updating flood hazard information. Many are developing and maintaining highly accurate data that can be used to update FEMA's Flood Hazard Maps. Others are taking an active role in reviewing requests for flood hazard map revisions prior to sending the requests to FEMA for processing. Some entities are also developing flood hazard data along previously unstudied waterways and sending these data to FEMA to include in map updates.

FEMA's Flood Hazard Mapping Program has historically encouraged strong Federal-state-local partnerships through a variety of cooperative programs. The intent is to strengthen mapping and floodplain management programs through increased cooperative actions and, thus, to reduce flood losses and disaster assistance.

The advantages of these cooperative agreements include the following: (1) local entities participate more in the development and ownership of the flood hazard information reflected on the flood hazard maps; (2) local entities have increased incentives to follow FEMA's guidelines and specifications as they develop data that will be used by both partners; (3) FEMA receives information that is more up-to-date, less costly, and more accurate; (4) flood hazard maps are updated using data the local entities are accustomed to using; and (5) local entities receive faster map updates and/or more extensive areas are updated.

The results of previous attempts by FEMA to develop cooperative agreements and programs to share data with and from local entities have been mixed. Some did not generate significant response nor result in the exchange of useful data, and some have worked well for all parties involved. Some of the previous agreements are better categorized as ad-hoc relationships with local entities. Those that have worked well and can be expanded to include other entities need to be better formalized.

To address these issues, Cooperating Technical Community (CTC) agreements will be developed, whereby communities will participate as active partners with FEMA in developing, reviewing, and maintaining flood hazard information and flood hazard mapping. Standard agreements will be developed for the 6 following categories for the CTC program:

1. ***Digital Base Map Data Sharing***

2. ***DFIRM 2.0 Preparation and Maintenance***

3. ***Engineering Data Development and Floodplain Mapping***

4. ***DFIRM 2.1 Preparation and Maintenance***

5. Risk Assessment

6. Engineering Review of Flood Hazard Analyses

By developing standardized CTC agreements, fewer reviews will be required and the partnership agreements can be implemented more quickly. In addition, "off the shelf" agreements requiring less customization are more likely to be implemented. However, these standardized agreements must also allow flexibility for local variation.

Local entities will choose one or more of the 6 agreement types. To be selected for participation in the CTC Program, local entities must demonstrate technical capability for the option chosen and a strong commitment to floodplain management in general. By using existing FEMA programs such as Community Assistance Visits and the Community Rating System as components of a local entity's demonstration of capabilities, the selection process will build on demonstrated and measured local expertise.

Standardized agreements will be developed in Fiscal Year 1998 and implemented in Fiscal Year 1999.

5. Public Awareness and Customer Service

Overview

To better educate the public about flood hazards and make the maps and related products easily accessible:

- A public outreach and education program utilizing the Internet and modern telecommunication capabilities will be developed.

- Enhanced map printing, distribution, and inventory procedures utilizing state-of-the-art technology will be implemented at the MSC.

Sections 2, 3, and 4 outlined plans for improving the accuracy, utility, and production processes of the flood hazard maps. However, without a public well informed about the flood peril and FEMA's Flood Hazard Mapping Program, the maps cannot fully accomplish their purpose of protecting citizens' lives, properties, and personal finances. The public must be educated, and the mapping products and information about FEMA's Flood Hazard Mapping Program made easily accessible.

To better inform the public, a formal outreach and education program, designed to promote the public awareness of, and confidence in, FEMA's Flood Hazard Maps and mapping processes, will be implemented. Efforts will also be concentrated on the MSC, which distributes the maps and mapping-related products and is one of FEMA's busiest customer centers.

Outreach and Education

Recommendation

Develop and implement a public outreach and education effort for FEMA's Flood Hazard Mapping Program.

Time Frame: Develop and implement the program in Fiscal Year 1998 and maintain as an ongoing effort thereafter.

The Federal Insurance Administration's *Cover America* campaign in educating the public about the availability of and need for flood insurance has been enormously successful. However, there is still inadequate awareness or understanding of the true flood hazards and how they affect property owners and others. In fact, upon learning that their property is located in a floodplain, many property owners presume that the flood hazard map is inaccurate. In addition, the general public does not understand the procedures for amending or revising the flood hazard maps. Also, LOMC requesters and map determination firms want up-to-the-minute status updates of upcoming map changes.

Much of the information needed and desired by the general public, flood hazard map users, and LOMC requesters already exists. The dilemma is that the public is not aware of, does not know how to obtain, or is not provided access to this information. Therefore, a structured public outreach and education program that exploits current information technologies will be developed. This program, which will increase the public's knowledge of flood hazards, the flood hazard maps, and mapping update processes in a format that provides quick, convenient access, will include:

Expanded use of FEMA's Web Site: With the public's increased use of the World Wide Web, expanding the use of FEMA's web site will be key to this public outreach and education program. Forms, books, brochures, key meeting minutes, answers to frequently asked questions, and tutorials will be made available on the web site. Additionally, an up-to-the-minute listing of the status of all historic and ongoing studies and LOMCs will be provided. The site will also include links to other important web sites, such as those of the MSC and the Federal Insurance Administration.

Customer-Service Telephone Response Line: For those customers who do not have access to the World Wide Web via the Internet, a customer-service telephone line for answering general questions about the flood hazard maps and mapping processes, as well as specific inquiries about ongoing updates, amendments, and revisions to flood hazard maps will be established. This customer-service line will be linked to the MSC's and Federal Insurance Administration's telephone response centers to efficiently transfer calls regarding map orders or flood insurance policies, and vice versa.

Development of Publicity Materials: Included in this effort will be the development of informational literature and a video training course for specific target audiences, such as local officials, real estate professionals, the general public, insurance agents, builders and developers, mortgage lenders, the Small Business Administration, and the Federal Highway Administration. These brochures will provide guidance on obtaining and interpreting flood hazard maps and mapping-related products. These materials will be distributed to FEMA Regional offices, Disaster Field Offices, NFIP state coordinators, real estate associations, lending institutions, and Write-Your-Own insurance agents, and at conferences and workshops where map users convene. The feasibility of using the existing marketing contract in place with the Federal Insurance Administration will be investigated.

The program will be developed and implemented in Fiscal Year 1999 and maintained as an ongoing effort thereafter.

Map Service Center

Recommendations

- Develop enhanced printing, distribution, and inventory procedures compatible with DFIRM 2.0 and 2.1 product specifications.
- Pursue other initiatives, including enhancements to the MSC web site, scanning the map negatives, and implementing bar code technology.

Time Frame:

- Develop specifications for new printing, distribution, and inventory procedures in Fiscal Year 1998 and implement in Fiscal Year 1999.
- Begin other initiatives in Fiscal Year 1999.

The MSC distributes the FEMA Flood Hazard Maps and mapping-related products, such as the FIS report and the twice-monthly publication of issued LOMCs, to a broad range of customers. The products distributed by the MSC are critical to FEMA's mitigation mission. Hence, the MSC is one of FEMA's most important customer-service hubs, receiving approximately 2,500 telephone calls weekly.

Orders for flood hazard maps and mapping-related products are received at the MSC via telephone, fax, or in writing. Orders are highly variable, with the peak often being twice the average, and are increasing at a rate of approximately 20% annually. Order volume is the highest after a flooding disaster and disrupts processing of normal orders because orders for the Disaster Field Office are the top priority and must be filled in one day.

As a result of the constraints of the traditional printing and distribution methods currently employed, the distribution of the flood hazard maps does not satisfy many users' demands to receive the maps quickly and in an electronic or digital format. Therefore, as the flood hazard mapping inventory and related products are converted to a digital format, the printing and distribution processes will also be modernized and automated to fully utilize existing technology.

Modernization efforts for the MSC will be concentrated in three primary areas: printing, customer interface, and inventory. Planned actions in each of these areas are outlined below.

Printing

- Develop the ability to print on demand.
- Develop the ability to print from an electronic file (computer-to-plate printing).
- Examine the implementation of color printing.
- Investigate the direct use of printing contractors in lieu of the Government Printing Office as the sole printing source during the digital conversion of the map inventory.

Customer Interface

- Enhance the capabilities of the MSC web site to:
  - ♦ distribute digital products,
  - ♦ provide indexing system to enable users to locate and download desired products,
  - ♦ create links to the FEMA web site and other relevant web sites, and
  - ♦ accept orders and payments.
- Modernize the telephone system to handle current caller demands and link to the Federal Insurance Administration and the Hazard Identification and Risk Assessment Division customer-service response lines.
- Implement the use of a MSC customer feedback form.
- Accept credit card payments and establish debit accounts.
- Develop an MSC newsletter and briefing package.

Inventory

- Immediately scan copies of all effective flood hazard map panels for archival use and to insure against a catastrophic loss of the camera-ready materials. Develop a specification that will support reprinting from the scanned file.
- Implement bar code technology on the flood hazard mapping products to facilitate inventory control and product distribution efficiency.
- Modify disaster response procedures to establish protocol for single points of contact at the MSC and the Disaster Field Office.
- Develop and implement a corrective plan to eliminate back-ordered and out-of-stock items.

In addition to the above changes, the implementation of a working capital fund will be explored. This fund, which would be established from proceeds from the sale of flood hazard maps and map products through the MSC, would be used directly for printing and distribution efforts when normal funding is insufficient or delayed.

6. Regulatory and Contractual Considerations

Overview

- The short-term changes in FEMA's Flood Hazard Mapping Program suggested in this report require no changes to the regulations.

- Some suggested long-term changes, such as use of the Internet to publish proposed BFE changes and the delegation of some map revision actions, will require legislative and/or regulatory changes.

- Contractual changes will be minimal; the majority require only updating the appropriate guidelines and specifications.

Regulatory Reform

The FEMA Flood Hazard Mapping Program has specific mandates within the National Flood Insurance Reform Act of 1994, the Flood Disaster Protection Act of 1973, the Housing and Urban Development Act of 1969, and the Housing and Urban Development Act of 1968. These Acts authorize FEMA to identify, publish, and update information with respect to all floodplain areas in the nation. FEMA is required by the Acts to consult with local officials in identifying flood-prone areas. Specific procedures are described in the Acts for establishing proposed flood elevations, as well as for notification of flood map changes, and reviewing the existing inventory of maps every five years to determine update needs.

The existing regulations identify the administrative procedures required to carry out the statutory mandates and were developed as the program evolved. Parts 65, 66, 67, 70, and 72 of the NFIP regulations refer to specific procedures to be followed in mapping activities. In the first two decades of the mapping program, the emphasis was on the initial identification and mapping of flood-prone areas. In the last decade, the emphasis has been on flood data updates. Current challenges for FEMA's Flood Hazard Mapping Program in terms of regulatory reform include:

- Ensuring that the mapping regulations are flexible enough to enable FEMA to capitalize on the technical and communication efficiencies made available through technology;
- Identifying situations that require revision of the regulations and issuing written policies to ensure that the intent of the NFIP's authorizing legislation is being carried out and to provide needed guidance and clarification to FEMA's internal and external customers; and
- Coordinating the development and issuance of mapping regulation and policy changes with all NFIP stakeholders, as is appropriate.

The short-term changes in FEMA's Flood Hazard Mapping Program suggested in this report can be accomplished with no changes to the regulations. However, two long-term legislative and regulatory changes have been identified as part of the mapping modernization plan.

These are:

- Publication of BFE changes using the Internet instead of local newspapers and the *Federal Register*. This will require legislative changes. Requirements currently established by local communities and

states regarding the publication of flood map changes will have to be considered prior to moving forward on this recommendation.

- Delegation of some map revision actions to qualified individuals. This action will require regulatory changes. Some of the mapping program's constituents have expressed concerns over this proposal. These concerns are being pursued by the Technical Mapping Advisory Council.

Beyond the specific issues identified in this report, an ongoing effort should be supported to ensure that the Hazard Identification and Risk Assessment Division focuses on needed changes to the regulations to ensure that the mapping program is successfully implementing the legislation. A concerted effort to resolve outstanding regulatory and policy issues, bring them to closure, and provide the Regional offices and FEMA's external customers with written guidance on the activities within the Hazard Identification and Risk Assessment Division should be a priority.

Contractual Changes

The contractual changes required to implement the mapping modernization plan presented in this report will be minimal. The primary change will be to implement the use of multi-year, indefinite delivery (i.e., task ordered) study contracts. There is no technical restriction to the use of such contracts. However, there may be a maximum monetary value for such contracts. This possibility will be investigated as the revised study procedures are implemented. The only other possible contractual change that will be required will be for the MSC to procure a direct contract with a printing contractor if it is decided to stop using the Government Printing Office as the sole printing source, as discussed in Section 5.

The remaining changes to implement this plan will involve revising and updating the *Guidelines and Specifications for Study Contractors*, the *Standards for Digital Flood Insurance Rate Maps*, the *Q3 Flood Data Specifications*, and the *Guidelines and Specifications for Technical Evaluation Contractors* to incorporate the new specifications discussed in this report and to modify deliverable procedures. In addition, statements of work with study contractors and TECs will have to be modified to reflect the deliverable and procedural changes, such as interim submissions by study contractors and the up-front compilation of data and mapping by the TECs for study contractor use.

7. What's Next?

Overview

To prepare for the implementation of the mapping modernization plan, several initiatives are underway or are planned for Fiscal Year 1998. These include:

- Analysis of the benefits and costs of the modernization plan
- Coordination with map user groups to prioritize the recommendations
- Development of a FEMA management structure for implementing the plan
- Development of new technical standards related to the recommendations in this report
- Conducting pilot projects utilizing the concepts and procedures recommended in this report

The map modernization plan will result in many benefits to the nation. The most significant and powerful of these is the generation of up-to-date flood hazard data and floodplain mapping that can be used to make siting and design decisions for new or improved structures so that potential flood damages to the structures and their contents can be minimized or avoided altogether. In addition, the improved digital format and base map information and electronic distribution mechanisms will improve the accuracy and efficiency of flood map determinations and insurance ratings. Other benefits include facilitation of sustainable development and the design of infrastructure to minimize flood damages. Finally, public awareness of the existence and severity of flood hazards will be heightened, the mandatory requirement to purchase flood insurance will be more fairly applied across the nation, and those most at risk of flood damage will purchase flood insurance.

As illustrated in this report, present funding for FEMA's Flood Hazard Mapping Program is insufficient to keep up with the demands and needs of the broadened user base. Increased funding is needed to properly maintain the mapping inventory and administer the mapping program. However, prior to committing the funding needed to implement the modernization plan, several concurrent actions must be taken over the next two years. These include the establishment of a FEMA management structure with the proper capacity and resources required to administer the plan and consultation with the map user groups for assistance in prioritizing the recommendations contained in the plan.

An immediate need is for a cost/benefit analysis, which is discussed in the following section.

Cost/Benefit Analysis

Before the map modernization plan can be implemented, it must be demonstrated that the benefits to the nation resulting from the plan will exceed the costs. Therefore, a detailed cost/benefit analysis is being conducted. This analysis includes a quantitative and qualitative analysis of benefits. The purpose of the analysis is to assess the overall merits of the map modernization plan and, if the plan is determined to be cost-beneficial, help establish priorities for implementation.

The eventual implementation of the modernization plan will depend upon the results of the cost/benefit analysis. If the analysis supports the plan, increased funding will allow FEMA to fully implement the plan and to exploit the economies of scale. Nevertheless, several initiatives recommended in the plan can be carried out within the funding of the ongoing, baseline program and are planned for the next two years. These are discussed in the following sections.

Development of Technical Standards

The recommendations in this report involve the development of new flood map products as well as many of the components for building these products. In Fiscal Year 1998, the following technical standards and specifications will be developed:

- Graphic and data specifications for the DFIRM 2.0 and 2.1 products;
- Source standards and graphic specifications for base maps to be used in producing DFIRM 2.0 and 2.1;
- Minimum standards for topographic mapping to be used to delineate floodplain boundaries in conducting flood data updates;
- Specifications for ERMs that emphasize the use of GPS technology and the National Spatial Reference System;
- Standardized agreements for CTC partnerships with state and local entities; and
- A standard operating procedure for verifying and, if warranted, revising the flood hazard maps as part of FEMA's post-flooding disaster response.

Other Ongoing Initiatives

The following initiatives are ongoing or planned to begin in Fiscal Year 1998:

- Conduct prototype studies that implement and test the concepts and recommendations outlined in this report. State-of-the-art flood maps will be prepared for the pilot communities for participation in the Disaster Resistant Communities initiative. Additionally, FEMA will participate in several partnerships with state agencies to develop flood hazard data and mapping. Included in these is a cooperative agreement with the State of Maryland to combine the Q3 Flood Data published by FEMA with digital orthophotographs prepared by the state. Also, FEMA is evaluating proposals from the State of New York for the state to develop updated flood hazard data and prepare digital floodplain mapping using integrated digital engineering modeling and mapping technologies in partnership with FEMA;
- Complete the national inventory of flood hazard mapping needs through the Five Year Map Update Needs Assessment by the end of Fiscal Year 1999. This will include an investigation and the development of mapping options, funding requirements, and a prioritized ranking for all communities without flood hazard maps in Fiscal Year 1998;
- Introduce the use of new multi-year, task-ordered contracts and implement the streamlined, re-engineered process for conducting FEMA-funded flood data updates;

- Begin developing an outreach and education program utilizing the Internet and telecommunication technologies; and

- Streamline and automate the procedures for reviewing, preparing, and distributing LOMC requests.